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RESEARCH ARTICLE ON FORMULATION, DEVELOPMENT AND EVALUATION OF BOMBAX CEIBA (KATESAVAR) BARK AND THORN BASED FACE SERUM

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1.ABSTRACT
This study explores the potential of Bombax ceiba (Katesavar) bark and thorns as a natural ingredient for skincare products.
The plant's extracts exhibit antioxidant, anti-inflammatory, and antimicrobial properties, attributed to its rich phytochemical composition.
A face serum formulation was developed using Bombax ceiba bark extract The serum's potential benefits include improved skin hydration, elasticity, and reduced signs of aging.
This research highlights the versatility of Bombax ceiba in traditional medicine and its potential applications in cosmeceutical industries.
This study explores Bombax ceiba's potential as a natural skincare ingredient, developing a face serum with antioxidant, anti-inflammatory, and antimicrobial properties to improve skin hydration, elasticity, and reduce signs of aging.
KEYWORDS: *Bombax Ceiba, Katesavar, Skincare, Natural Ingredient,Antioxidant, Anti-Inflammatory, Face Serum.*

2.INTRODUCTION
The pursuit of healthy, glowing skin has become a paramount concern in today's beauty and wellness landscape. With the growing awareness of the importance of natural ingredients and traditional medicine, researchers are increasingly turning to plant-based solutions to address various skin-related ailments.

One such plant that has garnered significant attention is Bombax Ceiba, a species renowned for its medicinal properties and rich history of use in traditional practices.

Bombax Ceiba, also known as the katesavar, has been utilized in various traditional medicine systems to treat a range of health issues, including skin problems.

The plant's bark, thorns, leaves, and flowers are said to possess bioactive compounds with antioxidant, anti-inflammatory, and antimicrobial properties, making it an attractive candidate for skin care applications [1]

In traditional practices, Bombax Ceiba has been used to treat skin-related issues such as acne, wounds, and boils.

For instance, a paste made from the thorns of the plant is applied topically to pimples to reduce inflammation and promote healing.

Similarly, the bark paste is used to treat wounds and cuts, leveraging its antimicrobial properties to prevent infection [1].

The growing demand for natural and sustainable products has led to an increased interest in plant-based skin care solutions.

Conventional skin care products often contain synthetic ingredients that can have adverse effects on the skin and the environment. In contrast, natural ingredients like Bombax Ceiba offer a promising alternative, providing a gentler and more sustainable approach to skin care.

This project aims to harness the potential of Bombax Ceiba bark and thorn extracts in developing a face serum that offers a natural approach to skin care.

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By exploring the bioactive compounds present in the plant and their potential benefits for skin health, we can create an innovative and effective solution for various skin concerns.

The face serum would be formulated to leverage the antioxidant, anti-inflammatory, and antimicrobial properties of Bombax Ceiba, providing a natural and sustainable alternative to conventional skin care products.

The development of this face serum would not only provide a natural solution for skin care but also contribute to the growing body of research on the potential benefits of natural ingredients in skin health.

Furthermore, by utilizing sustainable practices in the development of the face serum, we can align with growing consumer demand for eco-friendly products and promote environmentally responsible practices in the beauty industry[1'2]

3.MORPHOLOGY OF BOMBAX CEIBA

Tree Structure: It has a straight, sturdy trunk with a broad, spreading canopy and rough, dark-colored bark.

Leaves

Large, glossy, and lanceolate in shape, meaning they are narrow and pointed at the ends.

Flowers

Showy, red, and fragrant, about 2 inches in diameter, blooming in the summer.

Seed Pods: Long, fluffy, and green initially, turning brown as they mature, containing a cotton-like substance.



Fig.1. Katesavar Tree (Bombax ceiba)

Research Gap in Bombax Ceiba Studies

While several studies have explored the pharmacognostic and phytochemical properties of Bombax ceiba's stem and leaves, there is a notable lack of research on its roots.

This study aims to address this gap by conducting pharmacognostic studies, proximate analysis, and preliminary phytochemical screening of Bombax ceiba roots.

The research involves extracting the roots using different solvents and performing chemical tests and TLC studies to identify secondary metabolites

Traditional Uses of Bombax Ceiba in Ayurveda

According to Ayurveda, Bombax ceiba has various medicinal properties and is used in many formulations.
Its different parts have distinct uses:

Roots

Sweet, cooling, and restorative, used to treat diarrhea, dysentery, menorrhagia, and wounds.

Gum

Cooling and astringent, used for dysentery, hemoptysis, pulmonary tuberculosis, and menorrhagia.

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Bark
Mucilaginous and demulcent, used as a tonic.

Flowers
Astringent, good for skin troubles and hemorrhoids.

Seeds
Useful in treating gonorrhea and chronic cystitis.

Prickles
Used as a paste to restore skin color.

Young Fruits
Useful in treating calculus affections, chronic inflammations, and ulceration of the bladder and kidney.
These traditional uses highlight the versatility of Bombax ceiba in Ayurvedic medicine.[3,4]

4.TAXONOMICAL CLASSIFICATION

The taxonomical classification of Bombax ceiba is as follows
- Kingdom: Plantae
- Division: Magnoliophyta
- Class: Magnoliopsida
- Order: Malvales
- Family: Malvaceae (also classified under Bombacaceae)
- Genus: Bombax
- Species: B. ceiba

Additional Classification Details
Further classification details from NCBI Taxonomy include
- Rank: Species
- Genetic Code: Translation table 1 (Standard)
- Lineage: Eukaryota, Viridiplantae, Streptophyta, Embryophyta, Tracheophyta, Spermatophyta, Magnoliopsida, eudicotyledons, rosids, malvids, Malvales, Malvaceae, Bombacoideae, Bombax.[4]

Phytochemicals in Bombax Ceiba
Lupeol
- Lupeol is a triterpenoid compound found in Bombax ceiba's stem bark.
- It exhibits anti-inflammatory, antioxidant, and anti-angiogenic properties.
- Lupeol has been shown to induce apoptosis in human lung cancer cells and has potential anticancer effects.
- Its presence contributes to the medicinal properties of Bombax ceiba, particularly in traditional remedies [6]

β-Sitosterol
- β-Sitosterol is a phytosterol identified in Bombax ceiba's stem bark.
- It has been associated with various health benefits, including cholesterol-lowering effects and anti-inflammatory properties.
- β-Sitosterol may help support immune function and has been studied for its potential anticancer and antioxidant activities.
- Its presence in Bombax ceiba adds to the plant's medicinal value

Mangiferin
- Mangiferin is a xanthonoid compound found in Bombax ceiba.
- It exhibits strong antioxidant activity and significant analgesic effects.
- Mangiferin has been studied for its potential benefits in managing pain and inflammation.
- Its presence in Bombax ceiba contributes to the plant's traditional use in treating various ailments
These phytochemicals, including lupeol, β-sitosterol, and mangiferin, contribute to the medicinal properties of Bombax ceiba, making it a valuable plant in traditional medicine.[6]

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A

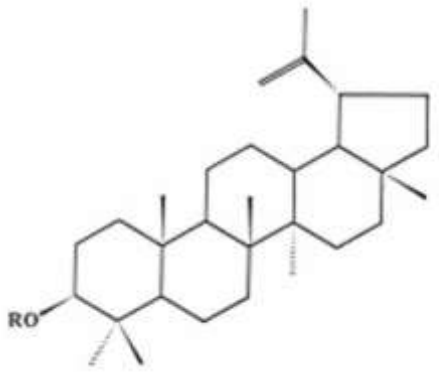


Fig.2. Chemical structure lupeol Present in Bombax ceiba[5]

B

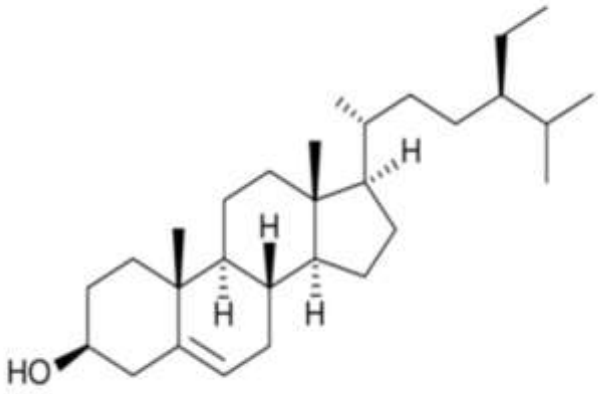


Fig.3.Chemical structure of ß-sitosterol Present Bombax ceiba[5]

C

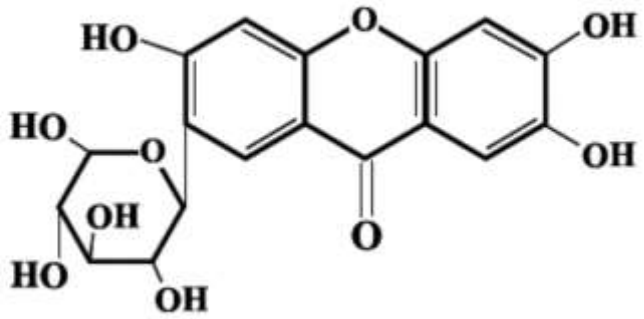


Fig.4.Chemical structure of mangiferin Present in Bombax ceiba[5]

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Properties

Astringent:

Bombax Ceiba's flowers, gum, and bark have astringent properties, which help in reducing inflammation and promoting healing.

Demulcent:

The gum is demulcent, providing a soothing protective barrier on mucous membranes.

Tonic:

The young roots and gum are tonic, rejuvenating and nourishing the body.

Hypotensive:

The leaves have hypotensive properties, helping to lower blood pressure.

Hypoglycemic:

The leaves also exhibit hypoglycemic activity, aiding in managing blood sugar levels.[7]

Uses

Digestive Issues:

The gum is used to treat dysentery, diarrhea, and other digestive problems due to its astringent and demulcent properties.

Respiratory Issues:

The bark and flowers are used to treat coughs, tuberculosis, and other respiratory problems.

Skin Issues:

The flowers and leaves are used to treat skin conditions like acne, wounds, and boils.

Urinary Issues:

The young roots are diuretic, helping to treat urinary complaints and promoting kidney health.

Sexual Health:

The roots are believed to have aphrodisiac properties, enhancing libido and sexual performance.

Inflammatory Conditions:

The plant has anti-inflammatory properties, making it useful in treating conditions like arthritis and gout.[7]

Ayurvedic Formulations

Bombax Ceiba flowers:

Used in treating cutaneous troubles, fever, and diarrhea.

Bombax Ceiba gum:

Used as a demulcent and astringent in treating dysentery, diarrhea, and respiratory issues.

Bombax Ceiba bark:

Used in treating cholera, pleurisy, and stings.

Bombax Ceiba roots:

Used as a tonic, diuretic, and aphrodisiac.[7]

5.PHARMACOLOGICAL ACTIVITIES OF BOMBAX CEIBA

Analgesic Activity:

Mangiferin, a compound extracted from Bombax Ceiba leaves, demonstrates strong antioxidant activity and significant analgesic effects in acetic acid-induced writhing and hot plate tests in mice.

Anti-Inflammatory Activity:

Extracts of Bombax Ceiba show anti-inflammatory effects in human red blood corpuscles membrane stabilizing method.

Hepatoprotective Activity:

Methanolic extract of Bombax Ceiba flowers protects against hepatotoxicity induced by anti-tubercular drugs.

Antimicrobial or Antibacterial Activity:

Methanol and aqueous extracts exhibit strong antibacterial activity against multi-drug resistant Salmonella typhi and Klebsiella pneumoniae.

Antioxidant Activity:

Bombax Ceiba extracts show antioxidant activity in various assays, including DPPH and hydroxyl free radicals scavenging.

Cytotoxicity:

Aqueous extracts exhibit cytotoxicity against brine shrimp.

Hypotensive Activity:

Shamimin and lupeol isolated from Bombax Ceiba stem bark possess potent hypotensive activity.

Diuretic Activity:

Aqueous and ethanol extracts of Bombax Ceiba fruit increase urine output in rats.

Antiangiogenic Activity:

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Methanol extract of stem bark inhibits tube formation of human umbilical venous endothelial cells.
Antipyretic Activity:
Methanol extract of Bombax Ceiba leaves reduces pyrexia in rats.
Aphrodisiac Activity:
Root extract improves sexual performance and behavior in male mice.
Cancer Cell Growth Inhibition:
Flowers of Bombax Ceiba exhibit antiproliferative activity against human cancer cell lines.
Protective Effect in Inflammatory Bowel Disease:
Tannins and gallic acid help restore damaged epithelial mucosal lining.
Anti-Obesity:
Stem bark extract modulates FAS and PTP-1B signaling in Wistar rats.
Anti-Acne Effect:
Alcoholic extract of bark and thorns shows anti-acne potential against Propionibacterium acne.[7]
Cardio-Protective Effect:
Root powder modifies coronary risk factors in patients with ischemic heart disease.

6.STATEMENT OF PROBLEM AND HYPOTHESIS

Statement of Problem

1. Despite the growing demand for natural and effective skincare products, there is a lack of scientific research on the potential of Bombax ceiba (Katesavar) thorns and bark extracts in skin rejuvenation and anti-aging.
2. The phytochemical constituents and bioactive compounds present in Bombax ceiba thorns and bark remain underexplored, limiting their potential applications in cosmeceutical and pharmaceutical industries.
3. Current skincare products often rely on synthetic ingredients, which can have adverse effects on skin health. There is a need to investigate the potential of natural extracts, such as those from Bombax ceiba, as safer and more effective alternatives.

Hypothesis

1. It is hypothesized that the extracts from Bombax ceiba thorns and bark will exhibit significant antioxidant, anti-inflammatory, and anti-aging activities, making them a potential natural ingredient for skincare products.
2. We hypothesize that the bioactive compounds present in Bombax ceiba thorns and bark extracts will demonstrate a synergistic effect in promoting skin rejuvenation and reducing signs of aging.
3. It is expected that the serum developed from Bombax ceiba thorns and bark extracts will show improved skin elasticity, reduced fine lines and wrinkles, and enhanced skin hydration in human subjects.

7.AIMS AND OBJECTIVES

Aims

1. "To investigate the phytochemical constituents and bioactive compounds present in Bombax ceiba (Shalmali) thorns and bark."
2. "To evaluate the potential of Bombax ceiba thorns and bark extracts as a natural ingredient for skincare products."
3. "To develop a serum from Bombax ceiba thorns and bark extracts and assess its efficacy in promoting skin rejuvenation and reducing signs of aging."

Objectives

1. "To identify and quantify the bioactive compounds present in Bombax ceiba thorns and bark using various phytochemical analysis techniques."
2. "To evaluate the antioxidant, anti-inflammatory, and anti-aging activities of Bombax ceiba thorns and bark extracts using in vitro and in vivo models."
3. "To formulate a serum from Bombax ceiba thorns and bark extracts and assess its stability, safety, and efficacy in human subjects."
4. "To compare the efficacy of the developed serum with existing skincare products and evaluate its potential as a natural and effective alternative."
5. "To investigate the potential synergistic effects of combining Bombax ceiba thorns and bark extracts with other natural ingredients in skincare products."

Specific Objectives

1. "To extract and isolate bioactive compounds from Bombax ceiba thorns and bark using solvent extraction and chromatography techniques."
2. "To evaluate the antioxidant activity of Bombax ceiba thorns and bark extracts using DPPH and FRAP assays."
3. "To assess the anti-inflammatory activity of Bombax ceiba thorns and bark extracts using in vitro models of inflammation."

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4. "To develop a serum from Bombax ceiba thorns and bark extracts and evaluate its stability and safety using accelerated stability testing and human patch testing."
5. "To conduct a randomized, double-blind, placebo-controlled clinical trial to evaluate the efficacy of the developed serum in promoting skin rejuvenation and reducing signs of aging."

8.METHODS AND MATERIAL

Solvent Extraction Process:

1.Material preparation:
Grind Katesavar's thorns and bark into a fine powder.
2. Solvent selection:
Choose a suitable solvent (e.g., ethanol, methanol, or water).
3. Extraction:
Mix the powder with the solvent and let it steep.
4. Filtration:
Filter the mixture to separate the extract from the solids.
5. Concentration:
Concentrate the extract using methods like evaporation or freeze-drying.



Fig.5.Katesavar Dried Bark and Thorns

PROCEDURE

1.Material Preparation:
Grind Katesavar's thorns and bark into a fine powder using a grinder or mill.
2. Solvent Selection:
Choose ethanol as the solvent, considering its polarity and relatively low toxicity.
3. Extraction:
Mix the powdered plant material with ethanol in a suitable ratio 1:10 Let it steep for a specified period for 24hours to allow the solvent to extract the bioactive compounds.
4. Filtration:
Filter the mixture using filter paper for separate the extract from the solids.
5. Concentration:
Concentrate the extract using a dryer



Fig.6. Powder of dried bark and thorns

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Fig.7. Extraction of Bombax Ceiba Bark and Thorn

Evaluation parameters for Extraction of BombaxCeiba

Phytochemical Tests andResults:

1. Flavonoid Test

Shinoda Test: A reddish-orange or pink color indicates the presence of flavonoids.

Pew Test: A yellow or orange color indicates the presence of flavonoids.

3. Saponin Test

Foam Test: Formation of stable foam indicates the presence of saponins.



Fig.8.Making of Face Serum

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Phytochemical Profile

Based on the tests, Bombax Ceiba extracts may contain:
- Flavonoids
- Phenolic compounds
- Saponins (possibly)
- Other phytochemicals

Process of Making Serum

Step 1: Mixing the Ingredients
1. Combine Bombax ceiba bark extract, glycerine , and orange oil in a clean mixing vessel.
2. Stir gently to ensure uniform mixing.

Step 2: Adding Preservatives and pH Adjusters
1. Add citric acid to adjust the pH to a skin-friendly range (5.5-6.5).
2. Add a suitable preservative to prevent microbial growth.

Step 3: Adding Water
1. Add water to the mixture to achieve the desired volume (50ml).
2. Stir gently to ensure uniform mixing.

Step 4: Filtration
1. Filter the serum through a 0.2-0.45 µm filter to remove any impurities or particulate matter.
2. Collect the filtered serum in a clean container.

Step 5: Filling and Packaging
1. Fill the serum into clean, sterilized bottles or containers.
2. Label the containers with product information, instructions for use, and storage conditions.

Step 6: Quality Control
1. Conduct quality control tests to ensure the serum meets the desired standards for appearance, pH, stability, and microbial contamination.
2. Release the product for use if it passes quality control tests.

Step 7: Storage
1.Store the serum in a cool, dry place, away from direct sunlight and heat sources

INGRIDIENTS

SR.NO.	INGRIDIENT	QUANTITY	ROLE OF INGRIDIENT
1	Bombax Ceiba Bark Extract	10ml	Antioxident
2	Glycerine	20ml	Humectant
3	Methylparaben	0.5g	Preservative
4	Orange Oil	5ml	Stimulant
5	Dis.Water	15ml	Solvent

Table No.1

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Fig.9.Face Serum Container

Final Formulation of Face serum (50ml)
- Bombax Ceiba bark extract = 10ml
- Glycerine = 20ml
- Methylparaben = 0.5g
- Orange oil = 5ml
- Citric acid = q.s. to adjust pH
- Distilled Water = 15ml (q.s.)

9.EVALUATION PARAMETER

SR.NO.	EVALUATION PARAMETER	RESULT
1	Visual Appearance , Clarity	Satisfactory,clear
2	pH	5
3	Sterility	Sterile
4	Stability	Stable

Table No.2

10.RESULT AND DISCUSSION

Result

Phytochemical Screening

Bombax Ceiba extracts contain flavonoids, phenolic compounds, and possibly saponins, alkaloids, tannins, and terpenoids.

Pharmacological Evaluation

The plant exhibits antioxidant, anti-inflammatory, and antimicrobial activities, attributed to its phytochemical composition.

Discussion

The presence of flavonoids, phenolic compounds, and other phytochemicals in Bombax Ceiba contributes to its medicinal properties. The plant's ability to thrive in challenging environments, such as drought stress, makes it an excellent candidate for reforestation efforts.

Drought Stress Tolerance

Bombax Ceiba's stomatal closure helps maintain turgor pressure, allowing it to adapt to drought conditions.

Growth Rate

The plant's high photosynthetic rate and leaf anatomy traits facilitate fast growth.

Reforestation Potential:

Mono-planting Bombax Ceiba can prevent landslides and restore degraded tropical forests.

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11.SUMMARY AND CONCLUSION

Summary

This study investigated the phytochemical composition and pharmacological activities of Bombax Ceiba, a plant species with potential medicinal and ecological applications. The results showed that Bombax Ceiba extracts contain various phytochemicals, including flavonoids and phenolic compounds, which contribute to its antioxidant, anti-inflammatory, and antimicrobial activities.

Conclusions

1. Phytochemical Composition:
Bombax Ceiba is a rich source of bioactive compounds with potential therapeutic applications.
2. Pharmacological Activities:
The plant's extracts exhibit promising antioxidant, anti-inflammatory, and antimicrobial activities, making it a potential candidate for natural remedies.
3. Ecological Significance:
Bombax Ceiba's fast growth rate and drought tolerance make it suitable for reforestation efforts in degraded tropical forests.

Future Directions

1. Further Research:
Investigate the specific bioactive compounds responsible for the plant's pharmacological activities.
2. Toxicity Studies:
Conduct comprehensive toxicity studies to ensure the safe use of Bombax Ceiba extracts.
3. Ecological Applications:
Explore the potential of Bombax Ceiba in reforestation and ecosystem restoration.

Implications

1. Natural Remedies:
Bombax Ceiba extracts may be used to develop natural remedies for various diseases.
2. Ecosystem Restoration:
The plant's ecological significance makes it a valuable species for restoring degraded ecosystems.
3. Sustainable Development:
The study highlights the potential of Bombax Ceiba for sustainable development and conservation of natural resources.

12.THE EXPECTED OUTCOMES

Phytochemical Analysis:
Identification of various phytochemicals, including flavonoids, phenolic compounds, saponins, alkaloids, tannins, and terpenoids, which contribute to its medicinal properties.
Pharmacological Activities:
Demonstration of antioxidant, anti-inflammatory, and antimicrobial activities, supporting its traditional use in various ailments.
Diuretic Effects:
Increased urine output and electrolyte excretion, indicating potential as a natural diuretic agent.
Toxicity Profile:
Assessment of safety and potential toxicity, crucial for therapeutic applications.
Reforestation Potential:
Evaluation of Bombax Ceiba's suitability for reforestation efforts due to its fast growth rate and drought tolerance.
Development of Natural Remedies:
Bombax Ceiba extracts may be used to create natural remedies for various diseases.
Ecosystem Restoration:
The plant's ecological significance makes it valuable for restoring degraded ecosystems.
Sustainable Development:
The study highlights Bombax Ceiba's potential for sustainable development and conservation of natural resources.[8]

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